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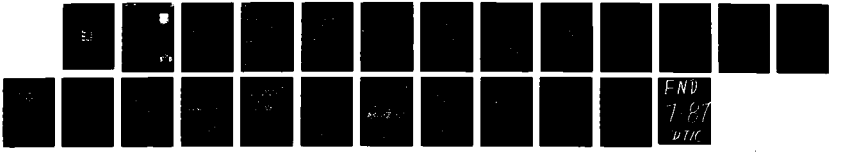

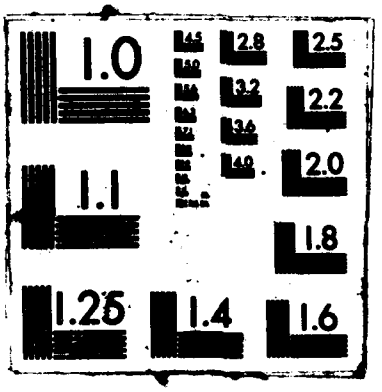
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Part 8

INTEGRATED INFORMATION SUPPORT SYSTEM (IISS)
Volume III - IISS Configuration Management
Part 8 - SCM Development Specification

General Electric Company
Production Resources Consulting
One River Road
Schenectady, New York 12345

Final Report for Period 22 September 1980 - 31 July 1985

November 1985

PREPARED FOR:

MATERIALS LABORATORY
AIR FORCE WRIGHT AERONAUTICAL LABORATORIES
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This report has been reviewed by the Office of Public Affairs (ASD/PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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from XeroX

This document is the development specification establishing the functional requirements of the IISS Software Configuration Management system which controls the storing and changing of IISS source code and controls software releases.

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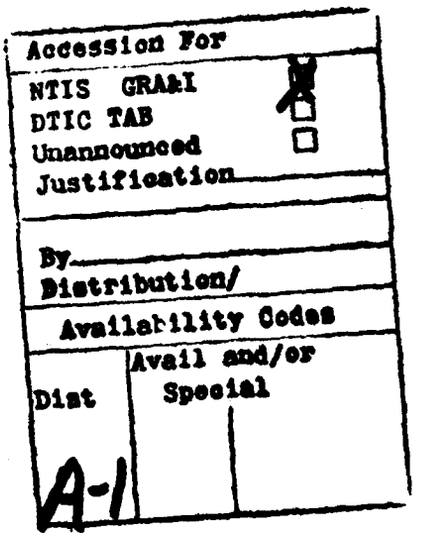

The Integrated Information Support System is a test computing environment used t
o investigate and demonstrate and test the concepts of information management an
d information integration in the contexts of Aerospace Manufacturing. Specifica
lly, IISS addresses the problems of integration of data resident on heterogeneou
s databases supported by heterogeneous computers, interconnected via a Local Are
a Network. A common Data Model is maintained and provides the mechanism require
d to integrate the data.

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PREFACE

This development specification covers the work performed under Air Force Contract F33615-80-C-5155 (ICAM Project 6201). This contract is sponsored by the Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio. It was administered under the technical direction of Mr. Gerald C. Shumaker, ICAM Program Manager, Manufacturing Technology Division, through Project Manager, Mr. David Judson. The Prime Contractor was Production Resources Consulting of the General Electric Company, Schenectady, New York, under the direction of Mr. Alan Rubenstein. The General Electric Project Manager was Mr. Myron Hurlbut of Industrial Automation Systems Department, Albany, New York.

Certain work aimed at improving Test Bed Technology has been performed by other contracts with Project 6201 performing integrating functions. This work consisted of enhancements to Test Bed software and establishment and operation of Test Bed hardware and communications for developers and other users. Documentation relating to the Test Bed from all of these contractors and projects have been integrated under Project 6201 for publication and treatment as an integrated set of documents. The particular contributors to each document are noted on the Report Documentation Page (DD1473). A listing and description of the entire project documentation system and how they are related is contained in document FTR620100001, Project Overview.

The subcontractors and their contributing activities were as follows:

TASK 4.2

Subcontractors	Role
Boeing Military Aircraft Company (BMAC)	Reviewer.
D. Appleton Company (DACOM)	Responsible for IDEF support, state-of-the-art literature search.
General Dynamics/ Ft. Worth	Responsible for factory view function and information models.

Subcontractors	Role
Illinois Institute of Technology	Responsible for factory view function research (IITRI) and information models of small and medium-size business.
North American Rockwell	Reviewer.
Northrop Corporation	Responsible for factory view function and information models.
Pritsker and Associates	Responsible for IDEF2 support.
SofTech	Responsible for IDEF0 support.

TASKS 4.3 - 4.9 (TEST BED)

Subcontractors	Role
Boeing Military Aircraft Company (BMAC)	Responsible for consultation on applications of the technology and on IBM computer technology.
Computer Technology Associates (CTA)	Assisted in the areas of communications systems, system design and integration methodology, and design of the Network Transaction Manager.
Control Data Corporation (CDC)	Responsible for the Common Data Model (CDM) implementation and part of the CDM design (shared with DACOM).
D. Appleton Company (DACOM)	Responsible for the overall CDM Subsystem design integration and test plan, as well as part of the design of the CDM (shared with CDC). DACOM also developed the Integration Methodology and did the schema mappings for the Application Subsystems.

Subcontractors	Role
Digital Equipment Corporation (DEC)	Consulting and support of the performance testing and on DEC software and computer systems operation.
McDonnell Douglas Automation Company (McAuto)	Responsible for the support and enhancements to the Network Transaction Manager Subsystem during 1984/1985 period.
On-Line Software International (OSI)	Responsible for programming the Communications Subsystem on the IBM and for consulting on the IBM.
Rath and Strong Systems Products (RSSP) (In 1985 became McCormack & Dodge)	Responsible for assistance in the implementation and use of the MRP II package (PIOS) that they supplied.
SofTech, Inc.	Responsible for the design and implementation of the Network Transaction Manager (NTM) in 1981/1984 period.
Software Performance Engineering (SPE)	Responsible for directing the work on performance evaluation and analysis.
Structural Dynamics Research Corporation (SDRC)	Responsible for the User Interface and Virtual Terminal Interface Subsystems.

Other prime contractors under other projects who have contributed to Test Bed Technology, their contributing activities and responsible projects are as follows:

Contractors	ICAM Project	Contributing Activities
Boeing Military Aircraft Company (BMAC)	1701, 2201, 2202	Enhancements for IBM node use. Technology Transfer to Integrated Sheet Metal Center (ISMC).

Contractors	ICAM Project	Contributing Activities
Control Data Corporation (CDC)	1502, 1701	IISS enhancements to Common Data Model Processor (CDMP).
D. Appleton Company (DACOM)	1502	IISS enhancements to Integration Methodology.
General Electric	1502	Operation of the Test Bed and communications equipment.
Hughes Aircraft Company (HAC)	1701	Test Bed enhancements.
Structural Dynamics Research Corporation (SDRC)	1502, 1701, 1703	IISS enhancements to User Interface/Virtual Terminal Interface (UI/VTI).
Systran	1502	Test Bed enhancements. Operation of Test Bed.

TABLE OF CONTENTS

SECTION 1

SCOPE

1.1 Identification

This specification establishes the development, test and qualification requirements of a computer program identified as the Software Configuration Management (SCM) subsystem. This is a configuration item of the Integrated Information Support System (IISS).

1.2 Functional Summary

SCM is used to control the storage and release of IISS software.

SECTION 2

DOCUMENTS

2.1 Reference Documents

1. General Electric Co.; Software Configuration Management User's Manual; 1 November 1985; CMU620124000.

2. General Electric Co.; Software Configuration Management User's Manual Supplement 1: IISS Release 2.0 Source Code, Alphabetical Listing; 25 July 1985; CMU620124000.

3. General Electric Co.; Software Configuration Management User's Manual Supplement 2: IISS Release 2.0 Source Code, Sorted by Subsystem and Subdirectory; 25 July 1985; CMU620124000.

4. General Electric Co.; Software Configuration Management Administrator's Manual; 1 November 1985; CMA620124000.

5. Interactive Systems Corporation; IS/Workbench for VAX/VMS Programmer's Guide Release 4.0; May 1983.

6. Interactive Systems Corporation; IS/Workbench for VAX/VMS User's Manual Release 4.0; April 1983.

2.2 Terms And Abbreviations

Digital Command Language (DCL): An interactive command language available under VAX/VMS.

Integrated Information Support System (IISS): A test computing environment used to investigate and demonstrate and test the concepts of information management and information integration in the context of Aerospace Manufacturing. The IISS addresses the problems of integration of data resident on heterogeneous computers interconnected via a local area network.

Software Configuration Management (SCM): A set of programs, some of which interface with SCCS code, that are used to control the storage and release of IISS software.

Source Code Control System (SCCS): A system for controlling changes to files of text, providing facilities for storing, updating, and retrieving any version of a file. SCCS, a product of Interactive Systems Corporation, is a collection of programs that run under the IS/WB system.

SECTION 3

REQUIREMENTS

3.1 Computer Program Definition

SCM is a system of code which stores current source code while preserving the history of changes to it. SCM controls changes to source code. SCM facilitates releases with automated functions. The SCM system consists of Source Code Control System (SCCS), some DCL code created by General Electric, and a C program to interface between the DCL and SCCS.

3.2 Detailed Functional Requirements

Broad SCM functional areas are described in this section.

3.2.1 Storing Source Code

Source code is stored in a well-protected location [SIISS] in files that preserve a history of changes to it and have associated with each change the release number, the date, the SPR number, and the person's account name. This function is carried out with NEWITEM, CHECKOUT, and RETURN.

3.2.2 Controlling Changing Of Source Code

Concurrency of making changes to the same file is avoided by the CHECKOUT function. When a file is checked out, a file is created in [CMDB.OUT] to keep a record of information on the checked out file. A file checkout is not allowed if [CMDB.OUT] already contains an entry with that file name.

Checkouts and checkprints are only allowed on the most recent version of a file. This is to avoid confusing the normal user who is interested only in the most recent version.

The specification of release number at the time of RETURN is allowed. This makes it possible to have concurrent development for different releases on different code.

3.2.3 Document Reasons For Newitems And Checkouts

Developers are required to submit an SPR prior to executing NEWITEM or CHECKOUT. This involves writing text to describe the problem being solved. Due to the common practice of submitting mass newitems and returns for a given release, this documentation is not usually very helpful.

3.2.4 Viewing Current Checkouts

Users are able to find out who has currently checked out a given file by using WHOHAS and what files are currently checked out by a given user by using HASWHO.

3.2.5 Creating Releases

VAX and IBM releases are created as automatically as possible from the stored source code. New releases are created from scratch in an empty release directory.

3.2.6 Changing Past Releases

The ability to change past releases was felt to be a desirable functionality. It was assumed that this could be done if it were possible to create a branch in the source code history file at the correct release level. In order to make this possible, a SCCS flag was added to the files in [SIISS] to create null nodes at any release levels that had had no changes. However this functionality was never entirely set up so that branching would be allowed. This was for two reasons. Branching would be confusing to most users and would lead to more inadvertent errors in changing files. And since in practice there are many changes allowed in the relocation, renaming, deletion, or addition of files, past releases could not be recreated using the normal release procedures anyway. In

a practical sense the only way to change a past release, given the current SCM practices, is to modify source code from a release tape.

3.3 Program Organization

The organization of SCM software will be described in this section in three parts: SCCS code, SCM user functions, and SCM administrative functions.

3.3.1 SCCS Code

The lowest level of visible SCM code is SCCS code. The SCCS commands that are used directly by SCM are ADMIN, GET, and DELTA. These commands are called only from CHKOUT.COM, CHKPRT.COM, RETURN.COM, and NEWITEM.COM. For detailed descriptions of the SCCS functions, see the referenced IS/Workbench manuals.

ADMIN is called by NEWITEM to create a new SCCS file. The release number, SPR number, person doing the newitem, and the date are all documented in the header section of the SCCS file.

GET is called by CHECKOUT and CHECKPRT in two different ways, with and without a -e keyletter. GET retrieves a readable version of the file. When the -e keyletter is used, the file may be subsequently changed with the DELTA function. At the time the -e keyletter is used, the release number that the change is to go in for is specified.

The functionality of specifying release number at the time of doing a RETURN was implemented by calling GET without the -e keyletter in CHECKOUT, then calling GET with the -e keyletter during RETURN, prior to the DELTA call which puts in the change. Thus a CHECKOUT is the same as a CHECKPRT except that during CHECKOUT, a file is created in [CMDB.OUT] to reserve the file so that it cannot be checked out concurrently.

The SCCS functions are all called through an interface program, INTER.C. This program calls the SCCS functions by creating a detached process with the UIC of SIISS.

The executables for INTER, DELTA, ADMIN, and DIFF are installed with special privileges in order to avoid protection problems that were encountered due to accessing CM from different UIC groups. The latter three have SYSPRV, and INTER has SYSNAM, DETACH, TMPMBX, and NETMBX.

3.3.2 SCM User Functions

A detailed description of how to use the user functions is provided in the SCM User's Manual.

The SCM user functions are run from the [IISSCM] directory. Most of these functions are standalone command procedures. The following is a list of all user functions, each followed by a list of called functions, if any. SCCS functions are indicated in capital letters. The functions that are only used by calls from other functions are in parentheses. The purpose of each module is given on following lines.

chkout.com - cvtdir,whohas,inter,valprob,GET

Obtain current copy of a file from SCM prior to changing it.

chkprt.com - cvtdir,inter,GET

Obtain current copy of a file from SCM for reading.

cmhelp.com

Give parameters for SCM functions, for expert mode.

(cvtdir.com)

Convert a directory from VMS format to UNIX format for SCCS.

defcm.com

Define the SCM functions (run by the SYSTARTUP command file).

dispose.com - whohas

Cancel a checkout without returning it to SCM.

haswho.com

Find out what files are checked out by an individual.

(inter.exe)

Interface with SCCS code, overriding SCCS protections.

newitem.com - cvtdir,inter,valprob,ADMIN

Enter new file into SCM.

pspr.com - pstats,valprob

Print a Software Problem Report.

(pstats.com) - wrtdet,wrthdr

Print a list of checked out files and returned files for an SPR .

return.com - cvtdir,whohas,inter,GET,DELTA

Put checked out file back into SCM with its changes.

rslspr.com - pstats,valprob

Close out (resolve) a Software Problem Report.

spr.com

Open a new Software Problem Report.

(valprob.com)

Delete leading zeroes from and SPR and check that the number is valid.

whohas.com

Find out who has checked out a particular file.

(wrtdet.com)

Format an information line for PSPR.

(wrthdr.com)

Write header information for PSPR.

3.3.3 SCM Administrative Functions

A detailed description of how to use the administrative functions is provided in the SCM Administrator's Manual.

The SCM administrative functions, including the VAX release procedures, are run from the [IISS.COM] directory. The IBM release procedures are analogous and are run from the [IISSIBM.COM] directory. Most of these functions are standalone command procedures. The following is a list of the administrative functions in [IISS.COM], each followed by a list of called functions, if any. The purpose of each module is given on following lines.

bldnddl.com

Create command files to compile and link NDDL files.

crellst.com

Create a link command file for RP main programs.

cvtnew.com

Enter files from NEWITEM.DAT into CI.DAT.

moveall.com

Move all needed files from IISS to TIISS for release testing.

updci.com

Update the CI.DAT file.

vbldcom.com - cvtdir (in [IISSCM])

Generate all needed command files for a given subsystem.

vcredo.com

Create a command file to compile, object library replace, and link a subsystem.

vcreget.com

Create a command file to do all gets and include library replaces.

vdelall.com - vdelete

Call vdelete for all subsystems.

vdelete.com

Delete files from IISS and recreate empty object libraries for a subsystem.

vdorun.com

Start a batch job to compile and link a subsystem.

vend.com

Update RELNUM.DAT at the end of a release.

vinit.com

Compile and library relace the ERRLOG subsystem files needed for linking the IPC subsystem.

vstart.com - cvtnew

Create a release directory and update CI.DAT with newitems.

vsubsys.com

Sort CI.DAT into separate temporary files for each subsystem.

3.4 Data Base Requirements

SCM is organized to require numerous data files, which are stored in [CMDB]. Most of the files are keyed to an SPR number and contain information relating to that SPR. The following provides a brief description of these files, where refers to the SPR number:

1. p .xrf - files checked out with SPR
2. pd .xrf - problem description
3. r .xrf - returns, newitems, and disposed (canceled) files with SPR
4. rd .dat - resolution description (if SPR resolved)
5. spr .dat - basic information on SPR (date, person filing, etc.)
6. spr .lis - file created during PSPR, a report on SPR status and files

The other data files in [CMDB] are the following:

1. "person's name".xrf - list of all files checked out by the person
2. ci.dat - the primary source code data file, used during releases
3. newitem.dat - each record is information about a newitem
4. return.dat - each record is information about a returned file
5. cancel.dat - each record is information about a

disposed (canceled) file

6. user.dat - list of privileged SCM users, can do newitems and checkouts

7. userr.dat - list of users with read privilege, can do checkprts

Some temporary data files are stored in [CMDB.OUT]. A file is created there whenever a checkout is done. The file is given the same name as the checked out file, except that if it is a system-dependent file the host letter is appended to the filename (V for VAX, I for IBM). The file contains information needed when the return is done, such as the SPR number and the SIISS subdirectory for the file.

SECTION 4

QUALITY ASSURANCE PROVISIONS

4.1 Introduction And Definitions

The assurance of software quality involves design considerations, testing, and debugging. "Design" involves the determination of coding standards, modular structure, data structures, and data storage for the software system. "Testing" involves running the software with a sufficient variety of inputs to assure the correctness of all possible paths through the code. "Debugging" is the process of isolation and correction of errors.

4.2 Computer Programming Test And Evaluation

The quality assurance of SCM software is handled differently from other IISS software. The SCM software is not part of IISS releases and is not used as part of the IISS product. Therefore it is not systematically tested with other IISS software. Since it is a tool used by the IISS development team to control software change and do releases, the code is constantly being tested by being used. When a user module is modified due to a required change in functionality or due to the need to solve a bug, the module is tested in a SCM development area prior to being moved to the SCM production area. When an administrative function is modified, it is tested by the SCM Administrator when it is used during the next release.

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